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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/781,314	02/17/2004	Youzhi E. Xu	42390P13563D	4855

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EXAMINER

FISCHER, JUSTIN R

ART UNIT	PAPER NUMBER
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1733

MAIL DATE	DELIVERY MODE
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08/27/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/781,314	Applicant(s) XU, YOUZHI E.	
	Examiner Justin R. Fischer	Art Unit 1733	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 June 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 16-22 and 24-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 16-22 and 24-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The indicated allowability of claim 23 is withdrawn in view of the newly discovered reference(s) to Pelrine '462 and Pelrine '236. Rejections based on the newly cited reference(s) follow.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 16, 17, 19, 20, 22, 24-28, and 30 rejected under 35 U.S.C. 103(a) as being unpatentable over Matayabas (US 2003/0128521, of record) and further in view of Pelrine (US 6,809,462, newly cited) and Pelrine (US 6,707,236, newly cited). As best depicted in Figure 1, Matayabas is directed to an apparatus/system comprising a printed circuit board, an integrated circuit chip 2 (heat generating device), an integrated heat spreader 6 (heat dissipating device), and a first thermal interface material 7 disposed between said integrated circuit chip and said integrated heat spreader (Paragraph 20). The reference further suggests that the thermal interface material can comprise a polymer matrix and a thermally conductive filler (Paragraph 21). In this instance, it appears that a covalent bond would necessarily result between the thermally conductive filler and both the integrated heat spreader and the integrated circuit chip. It is further noted that Figure 1 in the original disclosure depicts these bonds 124, 126 and

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there does not appear to be any unique processing that results in the occurrence of said bonds (disclosure in Paragraph 18 is related to the covalent bonds between the filler and the matrix, not the filler and the chip or spreader).

As to the thermal interface material, Matayabas suggests a wide variety of materials, including silicones and polyurethanes (Paragraph 22). While not expressly disclosed as such, several of the disclosed materials are recognized as being electroactive polymers, as shown for example by Pelrine '462 (Column 16, Lines 20-33) and Pelrine '236 (Column 4, Lines 24-43). Thus, one of ordinary skill in the art at the time of the invention would have found it obvious to form the thermal interface material from an electroactive polymer. Lastly, the particular method in which the electroactive polymer is applied is related to the manufacturing method and does not further define the structure of the claimed apparatus/system.

With respect to claim 19, the thermal interface material of Matayabas (matrix and filler) is seen to constitute a molecular composite material.

As to claim 20, Matayabas suggests a thermal interface material comprising thermally conductive fillers. In describing the fillers, Matayabas suggests the use of a wide variety of filler average particle sizes and distributions (Paragraph 31). It is additionally noted that the reference suggests the exemplary use of fillers having an average particle size less than 30 microns. It appears that such an arrangement is analogous to the claimed "nanocomposite" requirement as there is no quantitative distinction provided in the original disclosure. Furthermore, it is evident that Matayabas is directed to a wide variety of constructions in which extremely small filler materials are

included in the thermal interface material. Absent any conclusive showing of unexpected results, one of ordinary skill in the art at the time of the invention would have found it obvious to form said material with a nanocomposite material.

With respect to claims 22 and 28, as detailed above, the apparatus/system of Matayabas includes a thermal interface material comprising a polymer matrix and a thermally conductive filler, wherein said filler would be covalently bonded to the integrated circuit package and the integrated heat spreader. The reference further suggests that the "example embodiment" has a thermal conductivity of 3.4 W/mK (Paragraph 30). It is noted, however, that the reference further teaches one of ordinary skill in the art at the time of the invention would have been able to appropriately select the filler selection and weight percent as such parameters are recognized as affecting the properties (conductivity) of the thermal interface material. A fair reading of Matayabas suggests the use of thermal interface materials having a wide variety of conductivities, including those above 4 W/mK. One of ordinary skill in the art at the time of the invention would have been able to appropriately determine the desired conductivity as a function of the specific system/apparatus, there being no showing of unexpected results to establish a criticality for the claimed conductivity.

Regarding claim 24, as noted above, the heat dissipating device is an integrated heat spreader.

As to claim 25, the apparatus/system of Matayabas includes a heat sink 8.

With respect to claim 26, the apparatus/system of Matayabas includes a second thermal interface material 9 between said spreader and said heat sink. In a similar

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manner to the first thermal interface material, one of ordinary skill in the art at the time of the invention would expect a covalent bond between the thermally conductive filler of the second thermal interface material and the heat spreader or heat sink.

Regarding claim 30, Matayabas discloses an apparatus/system wherein the integrated circuit package is a C4 package (Figure 1).

4. Claims 18, 21, 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matayabas, Pelrine '462, and Pelrine '236 as applied in claim 16 above and further in view of Takeuchi (US 2003/0122242, of record). As detailed above, Matayabas substantially teaches the apparatus/system of the claimed invention, including the use of a first and second thermal interface material between respective components. In describing the thermal interface material, Matayabas suggests the exemplary use of a silicone-based gel; however, the reference further suggests that additional polymer matrices are within the scope of the reference, such as those based on polyurethanes, polyureas, anhydride-containing polymers, and the like. One of ordinary skill in the art at the time of the invention would have recognized this language as including any polymer matrix that is suitable for use in a thermal interface material, including epoxy (described as thermal epoxy), as shown for example by Takeuchi (Paragraph 20). In this instance, Takeuchi recognizes the use of a wide variety of material, including epoxies, for the polymer matrix. Absent any conclusive showing of unexpected results, one of ordinary skill in the art at the time of the invention would have found it obvious to use any of the well known materials, such as epoxy, used to form polymer matrices in thermal interface materials.


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Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Justin R. Fischer whose telephone number is (571) 272-1215. The examiner can normally be reached on M-F (7:30-4:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Crispino can be reached on (571) 272-1226. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


Justin R Fischer
Primary Examiner
Art Unit 1733

JRF
August 21, 2007